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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; Jan - 2017

Stability Analysis of Slopes and Earth Retaining Structures

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) If any missing data, assume suitably.iii) IS codes and charts are permitted.

UNIT - I

1 a. Explain Coulomb's earth pressure theory with neat sketch. 10

b. It is proposed to construct a gravity-retaining wall shown in Fig. Q 1(b) is 6 m high, with a backfill sloping at an inclination of 20º with the horizontal. The base of the wall is to be placed 1.5 m below the ground surface. The properties of the backfill material are $C_1 = 0$, $\phi_1 = 36º$ and $\gamma_1 = 18.1$ kN/m^3 and the angle of wall friction is $\delta = 23º$. The foundation soil is a cohesive friction soil with $C_2 = 35$ kN/m^4, $\phi_2 = 25º$ and $\gamma_2 = 19.0$ kN/m^3. Neglect wall friction in the front face of the wall. Unit weight of wall material is 23.5 kN/m^3. Proportion the dimensions of the retaining wall and check for safety against overturning and sliding. The water table is at a greater depth. 10

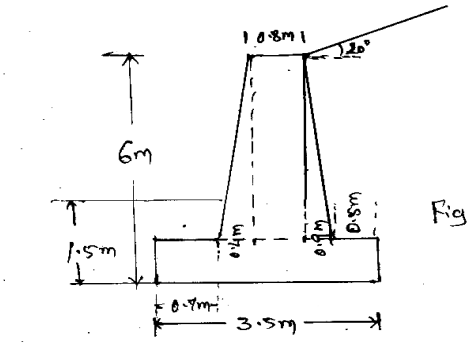

Fig Q 1(b)

2 a. Describe the procedure to determine the design depth of cantilever sheet piling in cohesive soils with granular backfill. 10

b. A cantilever sheet pile is to retain 3.5 m of sand. Water table is at 0.5 m from the top of the backfill. For the sand $\gamma = 19$ kN/m^3, $\gamma_1 = 12.2$ kN/m^3, $K_a = 0.2$ and $K_p = 5$. Find the depth of penetration for a factor of safety of 1.4. 10

UNIT - II

3 a. List and explain the types of landslides and slope movements. 10

b. An infinitely long slope having an inclination of 26º in an area is underlain by the firm cohesive soil G = 2.72 and e = 0.50. There is a thin, weak layer of soil 6 m below and parallel to the slope surface (C = 25 kN/m^2, $\phi' = 16º$). Compute the factor of safety when the slope is dry. If ground water flow could occur parallel to the slope on the ground surface, what factor of safety would result? 10

4 a. What are the effects of seepage, submerged and sudden draw down condition in an earthen dam? 12

b. A concrete dam is constructed across a river over a permeable stratum of soil of limited thickness. The water heads are upstream side 16 m and 2 m on the downstream side. 8

Contd….2

The flow net constructed under the dam given $N_f = 7.0$ and $N_d = 12.0$. Calculate the seepage loss through the subsoil, if the average value of the hydraulic conductivity is $6x10^{-3}$ cm/s horizontally and $3x10^{-4}$ cm/s vertically. Calculate the exit gradient, if the average length of the last field is 0.9 m.

UNIT - III

5 a. Explain stability analysis of infinite slopes with respect to cohesion soil. 10

b. What will be the factors of safety with respect to average shearing strength, cohesion and internal friction of a soil, for which the shear strength parameters obtained from the laboratory tests are $C' = 32$ kN/m^2 and $\phi' = 18^o$. The expected parameters of mobilized shearing resistance are $C'_m = 21$ kN/m^2 and $\phi'_m = 13^0$ and the average effective pressure on the failure plane is 110 kN/m^2. For the same value of mobilized shearing resistance determine the following : 10

i) Factor of safety with respect to height

ii) Factor of safety with respect to friction when that with respect to cohesion is unity

iii) Factor of safety with respect to strength.

6. Derive Bishop's simplified method of slices with neat sketch. 20

UNIT - IV

7 a. Describe the basic mechanics of reinforced earth and soil reinforcement. 10

b. Briefly describe the design of reinforced earth retaining wall. 10

8 a. Mention classification groups of geotextiles. Describe them briefly. 10

b. With neat sketch, explain the functions of geotextiles. 10

UNIT - V

9. Design for a strap footing for two columns A and B spaced 5 m centre to centre. Column A, 300 mm x 300 mm in size carries a load of 600 kN and is on property line. Column B, 400 mm x 400 mm in size carries a load of 900 kN. The bearing capacity of soil is 120 kN/m^2. Use M20 mix Fe 415 steel reinforcement. 20

10. Fig Q.10 shows the layout of columns of a building. The outer columns are 300x300 mm in size and carry a load of 500 kN each. The inner columns are 400 x 400 mm in size and carry a load 800 kN each. In addition to this each column carries a moment of 160 kN.m due to wind load on the length of the building. Design for raft foundation, if the bearing capacity of soil is 100 kN/m^2. Use M20 concrete and Fe 415 steel. 20

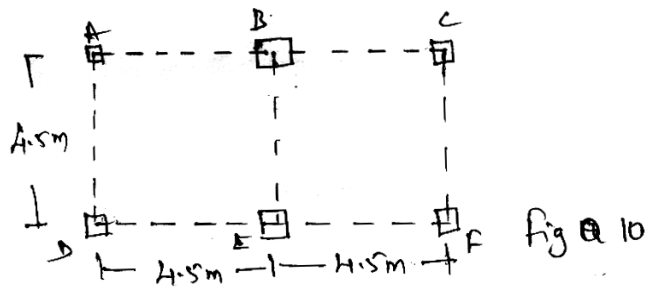

fig Q 10

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